Data Sheet

Modular Programmable DC Electronic Load

MDL Series

The MDL Series is a multi-channel modular programmable electronic load system. Six different modules of programmable DC loads ranging in power from 200 W to 600 W provide users the flexibility to test a wide range of power sources from multi-output AC/DC power supplies to batteries, fuel cells, and photovoltaic arrays.

The mainframe has four slots that can be configured with any assortment of the modules up to 2400 W (up to 4800 W with mainftame extension). The high-performance electronic load modules of the MDL Series are capable of operating in constant current (CC), constant voltage (CV), constant resistance (CR), constant power (CW), and constant impedance (CZ) mode, which uses DSP technology to simulate non-linear loads and realistic loading behavior.

Easily edit the load's parameters such as voltage, current, slew rate, and width via the front panel. Increase productivity by saving your test parameters into any one of the 101 memory areas for quick system recall. Additionally, the MDL Series provides 16-bit resolution as well as numerous protection modes and a power-on system self-test to ensure the reliability of your testing.

For remote communication, the MDL series provides LAN, USBTMC compliant USB, RS232, and GPIB standard interfaces that support SCPI command protocol.

Modules	MDL200	MDL252	MDL305	MDL400	MDL505	MDL600
Power	200 W	250 W*	300 W	400 W	500 W	600 W
Operating Voltage	80 V	80 V	500 V	80 V	500 V	80 V
Rated Current	40 A	20 A	20 A	60 A	30 A	120 A
No. of Channels	1	2	1	1	1	1

* The MDL252 is a dual-channel 250 W load module supporting a unique flexible power configuration. The user can allocate up to 250 W to either channel up to 300 W total (e.g. 50 W/250 W, 250 W/50 W, 150 W/150 W), thus replacing many dual-channel modules with fixed power distribution.

Features and Benefits

- Power range up to 2400 W
- Voltage range up to 500 V
- Current range up to 120 A
- CC/CV/CR/CW/CZ operating modes
- Removable modules for easy system configurability
- Support for up to 16 channels with mainframe extension
- Operate identical modules in parallel mode for high current applications
- Synchronous Load on/off function
- Standard LAN, GPIB, USB, and RS-232 interfaces with USBTMC/SCPI protocol support
- Analog current control and monitoring
- Transient mode up to 25 kHz
- List mode (sequence mode) - minimum 20 μs step width with 84 user programmable steps
- Adjustable slew rate in CC mode
- 16-bit voltage and current measurement system providing high resolution of 0.1 mV and 0.01 mA
- Automatic test function
- 101 memory locations to save/recall setting parameters
- Remote sense
- OVP/OCP/OPP/OTP and reverse voltage protection

Technical data subject to change
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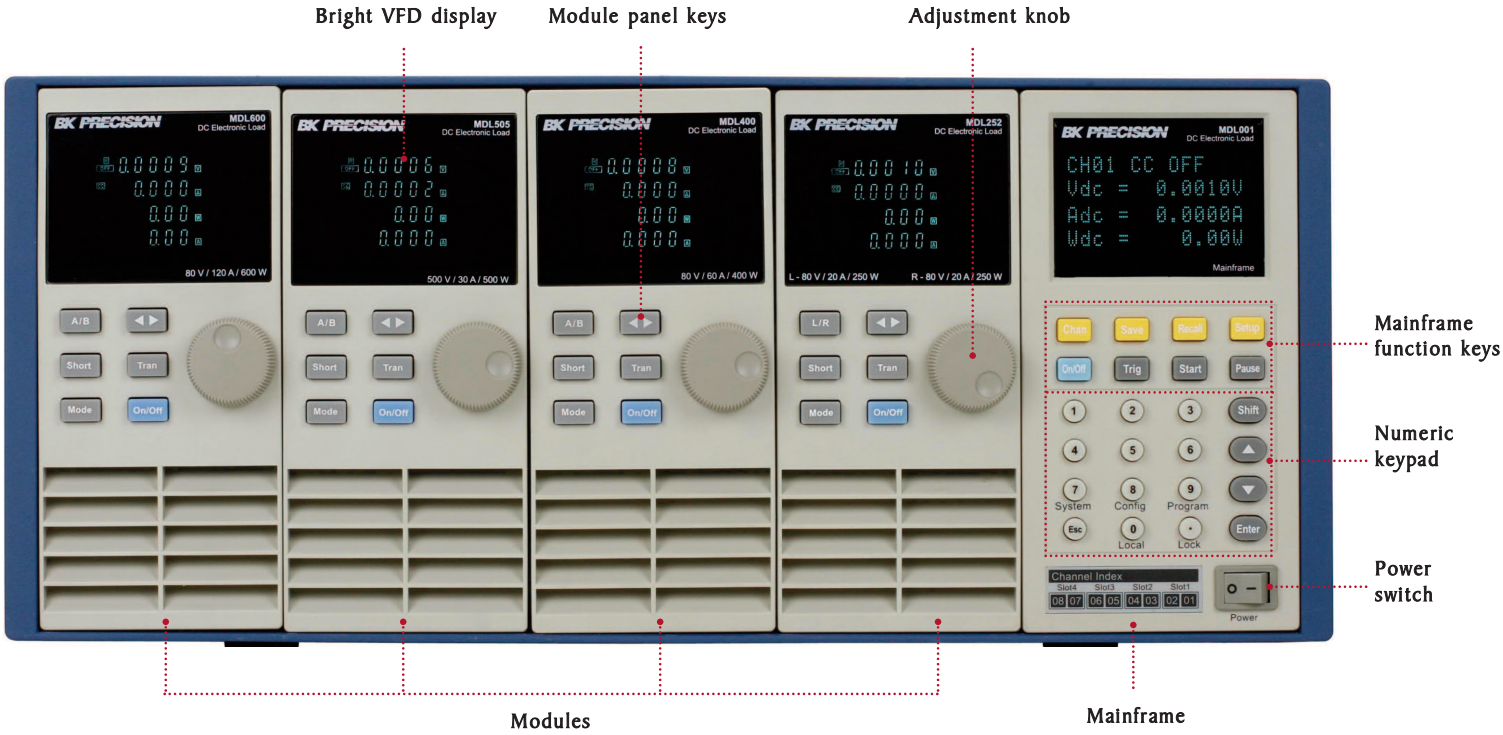
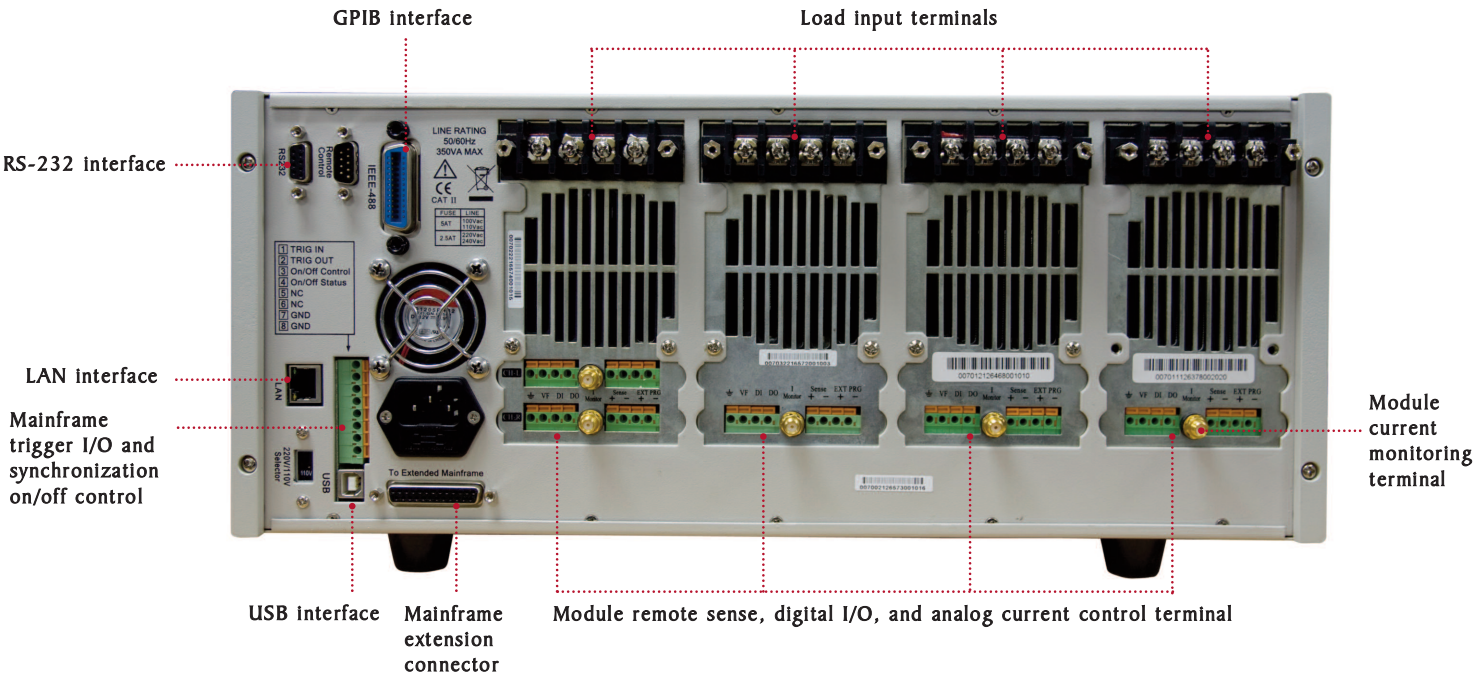
ELECTRONIC TEST INSTRUMENTS

▲ Front panel



▲ Rear panel



The tools you need

High performance architecture

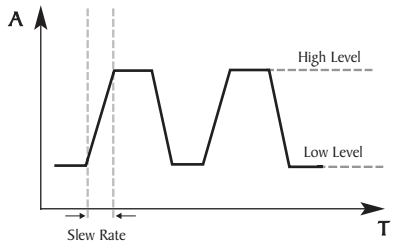
Equipped with a high-performance microprocessor in every mainframe and module, the MDL Series programmable DC electronic load utilizes a parallel architecture that provides a high measurement speed. Additionally, a simultaneous load on/off operation can be performed through the front panel, analog control terminal, or remote SCPI command. This configuration allows the system to control modules synchronously and increases productivity in testing.

Modular design

With removable module design, you can choose suitable load modules to modify the system according to your requirements. This design allows for multiple channels and is ideal for testing several units, especially power supplies with multiple outputs. At the same time, all load modules can be configured to work independently. All load modules, including the high power 500 W and 600 W modules can fit in one slot. Unlike competitor models that require two slots for high power modules, the MDL Series offers a one-slot form factor for all modules.

Transient operation

Transient operation enables the module to periodically switch between two load levels. A power supply's regulation and transient characteristic can be evaluated by monitoring the supply's output voltage under varying combinations of load levels, duty cycle, and slew rate. The MDL Series can simulate these conditions up to 25 kHz.



Powerful communication interfaces

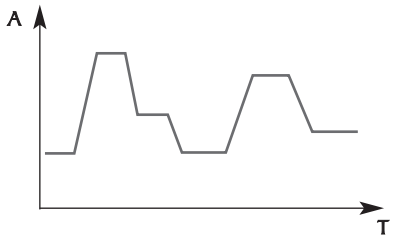
The MDL Series mainframe offers all the latest options to the user for remote communication. Connect via GPIB, Ethernet, USB, or RS232 to carry out data communication through SCPI and USBTMC standard communication protocols to control all your electronic load modules from a PC.

Adjustable slew rate

In constant current mode, users can control the rate or slope of the change in current in a transient response test. Set the slew rate to as slow as 0.0001 A/μs or as fast as 2.5 A/μs depending on the module and selected current range.

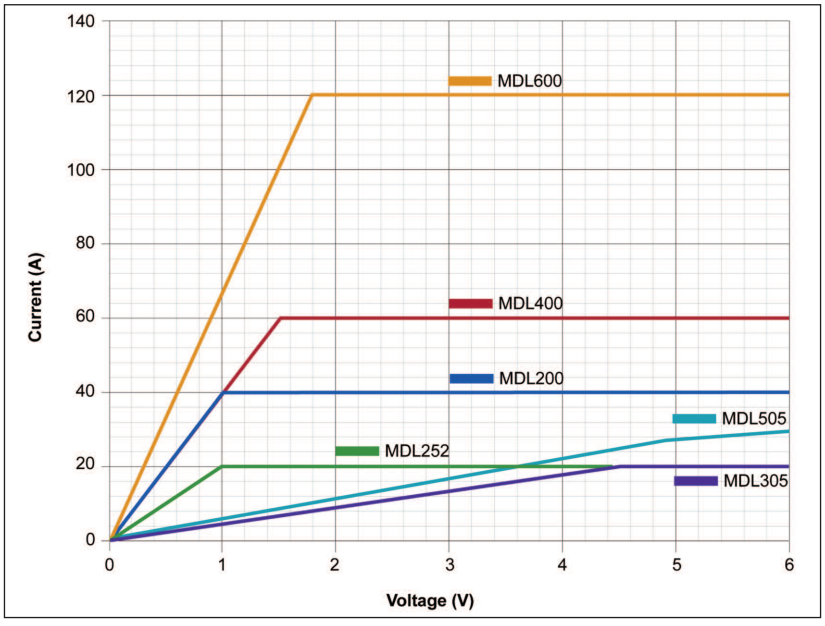
List mode

Not limited to just switching between two levels, list mode lets you generate more complex sequences of input changes with several different levels. Up to 7 groups of list files can be saved in the mainframe. Each list can contain up to 84 steps with a minimum width time of 20 μs per step.



Low Voltage Operation

The MDL series can operate at low voltages for applications such as fuel cell and solar cell testing.



Typical minimum operating voltage at full scale current:

MDL200	MDL252	MDL305	MDL400	MDL505	MDL600
1 V	1 V	4.5 V	1.5 V	5.4 V	1.8 V

Automatic test mode

The MDL Series can execute multiple test sequences across all channels. Sequences can be cascaded, and each step can be programmed with upper and lower limit values. When applied in automatic production testing, you can easily judge whether the test parameters of your devices are within the specification limits and adjust your process according to the GO/NG verdict.

Specifications

Model		MDL200	MDL252	MDL305	MDL400	MDL505	MDL600
Input ratings							
Input Voltage		0-80 V	0-80 V	0-500 V	0-80 V	0-500 V	0-80 V
Input Current	Low	0-4 A	0-3 A	0-3 A	0-6 A	0-3 A	0-12 A
	High	0-40 A	0-20 A	0-20 A	0-60 A	0-30 A	0-120 A
Input Power		200 W	250 W [1]	300 W	400 W	500 W	600 W
Channels		1	2	1	1	1	1
Minimum Operating Voltage	Low	0.10 V at 4 A	0.15 V at 3 A	0.7 V at 3 A	0.15 V at 6 A	0.54 V at 3 A	0.18 V at 12 A
	High	1 V at 40 A	1 V at 20 A	4.5 V at 20 A	1.5 V at 60 A	5.4 V at 30 A	1.8 V at 120 A
CV mode							
Range	Low	0-18 V					
	High	0-80 V	0-80 V	0-500 V	0-80 V	0-500 V	0-80 V
Resolution	Low	1 mV					
	High	10 mV					
Accuracy	Low	± (0.05 % + 0.02 % F.S.)					
	High	± (0.05 % + 0.025 % F.S.)					
CC mode							
Range	Low	0-4 A	0-3 A	0-3 A	0-6 A	0-3 A	0-12 A
	High	0-40 A	0-20 A	0-20 A	0-60 A	0-30 A	0-120 A
Resolution	Low	0.1 mA				1 mA	0.1 mA
	High	1 mA				10 mA	1 mA
Accuracy	Low	± (0.05 % + 0.05 % F.S.)					± (0.05 % + 0.1 % F.S.)
	High	± (0.05 % + 0.05 % F.S.)					± (0.1 % + 0.1 % F.S.)
CR mode							
Range	Low	0.05 Ω-10 Ω	0.05 Ω-10 Ω	0.25 Ω-10 Ω	0.05 Ω-10 Ω	0.2 Ω-10 Ω	0.2 Ω-10 Ω
	High	10 Ω-7.5 kΩ					
Resolution		16-bit					
Accuracy	Low	± (0.01 % + 0.08 % F.S.)					
	High	± (0.01 % + 0.0008 % F.S.)					
CW mode							
Range		200 W	250 W	300 W	400 W	500 W	600 W
Resolution		10 mW					
Accuracy		± (0.2 % + 0.2 % F.S.)					
Transient mode (CC mode)							
T1&T2		20 us-3600 s / Res: 5 μs-10 ms					
Accuracy		5 μs+100 ppm					
Slew Rate [2]	Low	0.0001-0.25 A / μs	0.0001-0.2 A / μs	0.0001-0.1 A / μs	0.0001-0.25 A / μs	0.0001-0.1 A / μs	0.0001-0.25 A / μs
	High	0.001-2.5 A / μs	0.001-2 A / μs	0.001-1 A / μs	0.001-2.5 A / μs	0.001-1 A / μs	0.001-2.5 A / μs

1) MDL252: The user can allocate up to 250 W to either channel up to 300 W total (e.g. 50 W/250 W, 250 W/50 W, 150 W/150 W).

2) The slew rate specifications are not warranted, but are descriptions of typical performance. The actual transition time is defined as the time for the input to change from 10% to 90%, or vice versa, of the programmed current values. In case of very large load changes, e.g. from no load to full load, the actual transition time will be larger than the expected time. The load will automatically adjust the slew rate to fit within the range (high or low) that is closest to the programmed value.

Specifications

Model		MDL200	MDL252	MDL305	MDL400	MDL505	MDL600
Readback voltage							
Range	Low	0-18 V					
	High	0-80 V	0-80 V	0-500 V	0-80 V	0-500 V	0-80 V
Resolution	Low	0.1 mV	0.1 mV	1 mV	0.1 mV	1 mV	0.1 mV
	High	1 mV	1 mV	10 mV	1 mV	10 mV	1 mV
Accuracy		± (0.025 % + 0.025 % F.S.)					
Readback current							
Range	Low	0-4 A	0-3 A	0-3 A	0-6 A	0-3 A	0-12 A
	High	0-40 A	0-20 A	0-20 A	0-60 A	0-30 A	0-120 A
Resolution	Low	0.01 mA	0.01 mA	0.01 mA	0.1 mA	0.01 mA	0.1 mA
	High	0.1 mA	0.1 mA	0.1 mA	1 mA	0.1 mA	1 mA
Accuracy	Low	± (0.05 % + 0.05 % F.S.)					± (0.05 % + 0.1 % F.S.)
	High	± (0.05 % + 0.05 % F.S.)					± (0.1 % + 0.1 % F.S.)
Readback power							
Range		200 W	250 W	300 W	400 W	500 W	600 W
Resolution		10 mW					
Accuracy		± (0.2 % + 0.2 % F.S.)					
Protection range							
OPP		≈ 200 W	≈ 250 W	≈ 300 W	≈ 400 W	≈ 500 W	≈ 600 W
OCP	Low	≈ 4.4 A	≈ 3.3 A	≈ 3.3 A	≈ 6.6 A	≈ 3.3 A	≈ 13.2 A
	High	≈ 44 A	≈ 22 A	≈ 22 A	≈ 66 A	≈ 33 A	≈ 132 A
OVP		≈ 82 V	≈ 82 V	≈ 510 V	≈ 82 V	≈ 510 V	≈ 82 V
OTP		185 °F (85 °C)					
General							
Short Circuit							
Current (CC)	Low	≈ 4 A	≈ 3 A	≈ 3 A	≈ 6 A	≈ 3 A	≈ 12 A
	High	≈ 40 A	≈ 30 A	≈ 20 A	≈ 60 A	≈ 30 A	≈ 120 A
Voltage (CV)		0 V					
Resistance (CR)		≈ 25 mΩ	≈ 50 mΩ	≈ 220 mΩ	≈ 25 mΩ	≈ 180 mΩ	≈ 15 mΩ
Input Terminal Impedance		≈ 300 kΩ	≈ 300 kΩ	≈ 1 MΩ	≈ 300 kΩ	≈ 1 MΩ	≈ 300 kΩ
Safety		EN61010-1:2001, EU Low Voltage Directive 2006/95/EC					
Electromagnetic Compatibility		Meets EMC Directive 2004/108/EC, EN 61000-3-2:2006, EN 61000-3-3:1995+A1:2001+A2:2005 EN 61000-4-2/-3/-4/-5/-6/-11, EN 61326-1:2006					
Dimensions		3.2" x 7.2" x 22.6" (82 x 183 x 573 mm)					
Weight		11 lbs (5 kg)					
Three-Year Warranty							

Mainframe Specification

Number of Slots	Power Input	Operating Temperature	Storage Temperature	Humidity
4	110/220 V ±10%, 50/60 Hz	32 to 104 ºF (0 to 40 °C)	14 to 140 ºF (-10 to 60 °C)	Indoor use, ≤ 95%

Note: Applies to MDL001 mainframe and MDL002 mainframe extension.

Mechanical Specifications

Model	Type	Dimensions (W x H x D)	Weight
MDL001	Mainframe	17.5" x 7.2" x 21.6" (445 x 183 x 549 mm)	34 lbs (15.4 kg)
MDL002	Mainframe Extension	17.5" x 7.2" x 21.6" (445 x 183 x 549 mm)	34 lbs (15.4 kg)
MDL200	Module	3.2" x 7.2" x 22.6" (82 x 183 x 573 mm)	11 lbs (5 kg)
MDL252	Module	3.2" x 7.2" x 22.6" (82 x 183 x 573 mm)	11 lbs (5 kg)
MDL305	Module	3.2" x 7.2" x 22.6" (82 x 183 x 573 mm)	11 lbs (5 kg)
MDL400	Module	3.2" x 7.2" x 22.6" (82 x 183 x 573 mm)	11 lbs (5 kg)
MDL505	Module	3.2" x 7.2" x 22.6" (82 x 183 x 573 mm)	11 lbs (5 kg)
MDL600	Module	3.2" x 7.2" x 22.6" (82 x 183 x 573 mm)	11 lbs (5 kg)

Standard Accessories

Mainframes	Power cord, user manual, mainframe extension cable (MDL002 only)
Modules	Certificate of calibration and test report

Optional Accessories

Rack mount kit IT-E153 for mainframes MDL001 and MDL002